查询TEA1094供应商

DATA SHEET

TEA1094; TEA1094A
Hands free IC

Product specification
Supersedes data of 1996 Mar 11
File under Integrated Circuits, IC03

1996 Jul 15

Philips
Semiconductors

PHILIPS

FEATURES

- Low power consumption
- Power-down function (TEA1094A only)
- Microphone channel with:
  - externally adjustable gain
  - microphone mute function.
- Loudspeaker channel with:
  - externally adjustable gain
  - dynamic limiter to prevent distortion
  - rail-to-rail output stage for single-ended load drive
  - logarithmic volume control via linear potentiometer
  - loudspeaker mute function.
- Duplex controller consisting of:
  - signal envelope and noise envelope monitors for both channels with:
    externally adjustable sensitivity
    externally adjustable signal envelope time constant
    externally adjustable noise envelope time constant
  - decision logic with:
    externally adjustable switch-over timing
    externally adjustable idle mode timing
    externally adjustable dial tone detector in receive channel
  - voice switch control with:
    adjustable switching range
    constant sum of gain during switching
    constant sum of gain at different volume settings.

APPLICATIONS

- Mains, battery or line-powered telephone sets with hands-free/listening-in functions
- Cordless telephones
- Answering machines
- Fax machines.

GENERAL DESCRIPTION

The TEA1094 and TEA1094A are bipolar circuits intended for use in mains, battery or line-powered telephone sets, cordless telephones, answering machines and Fax machines. In conjunction with a member of the TEA106X, TEA111X families of transmission circuits, the devices offer a hands-free function. They incorporate a microphone amplifier, a loudspeaker amplifier and a duplex controller with signal and noise monitors on both channels.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TEA1094	DIP28	plastic dual in-line package; 28 leads (600 mil)	SOT117-1
TEA1094A	DIP24	plastic dual in-line package; 24 leads (600 mil)	SOT101-1
TEA1094T	SO28	plastic small outline package; 28 leads; body width 7.5 mm	SOT136-1
TEA1094AT	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
TEA1094AM	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1

QUICK REFERENCE DATA

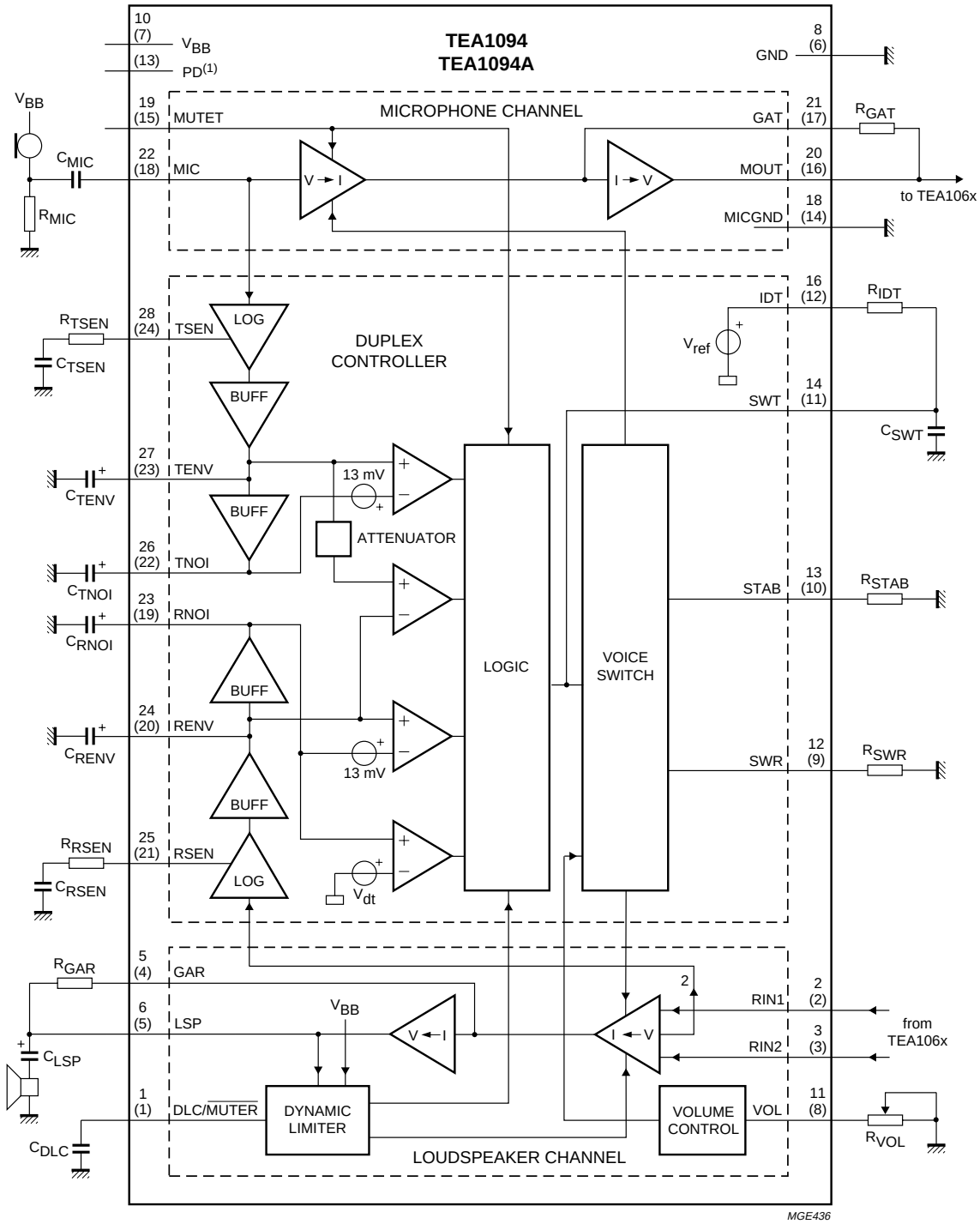
V_{BB} = 5 V; V_{GND} = 0 V; f = 1 kHz; T_{amb} = 25 °C; MUTET = LOW; PD = LOW (TEA1094A only); R_L = 50 Ω; R_{VOL} = 0 Ω; measured in test circuit of Fig.12; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{BB}	supply voltage		3.3	–	12.0	V
I_{BB}	current consumption from pin V_{BB}		–	3.1	4.4	mA
G_{vtx}	voltage gain from pin MIC to pin MOUT in transmit mode	V_{MIC} = 1 mV (RMS); R_{GAT} = 30.1 kΩ	13	15.5	18	dB
ΔG_{vtxr}	voltage gain adjustment with R_{GAT}		–15.5	–	+15.5	dB
G_{vrx}	voltage gain in receive mode; the difference between RIN1 and RIN2 to LSP	V_{RIN} = 20 mV (RMS); R_{GAR} = 66.5 kΩ; R_L = 50 Ω	16	18.5	21	dB
ΔG_{vrxr}	voltage gain adjustment with R_{GAR}		–18.5	–	+14.5	dB
$V_{O(p-p)}$	output voltage (peak-to-peak value)	V_{RIN} = 150 mV (RMS); R_{GAR} = 374 kΩ; R_L = 33 Ω; V_{BB} = 9.0 V; note 1	–	7.5	–	V
SWRA	switching range		–	40	–	dB
ΔSWRA	switching range adjustment with R_{SWR} referenced to R_{SWR} = 365 kΩ		–40	–	+12	dB
T_{amb}	operating ambient temperature		–25	–	+75	°C

Note

1. Corresponds to 200 mW output power.

BLOCK DIAGRAM



The pin numbers given in parenthesis are for the TEA1094A.

(1) TEA1094A only.

Fig.1 Block diagram.

PINNING

SYMBOL	PINS		DESCRIPTION
	TEA1094	TEA1094A	
DLC/$\overline{\text{MUTER}}$	1	1	dynamic limiter timing adjustment; receiver channel mute input
RIN1	2	2	receiver amplifier input 1
RIN2	3	3	receiver amplifier input 2
n.c.	4	–	not connected
GAR	5	4	receiver gain adjustment
LSP	6	5	loudspeaker amplifier output
n.c.	7	–	not connected
GND	8	6	ground reference
n.c.	9	–	not connected
V_{BB}	10	7	supply voltage
VOL	11	8	receiver volume adjustment
SWR	12	9	switching range adjustment
STAB	13	10	reference current adjustment
SWT	14	11	switch-over timing adjustment
n.c.	15	–	not connected
IDT	16	12	idle mode timing adjustment
PD	–	13	power-down input
n.c.	17	–	not connected
MICGND	18	14	ground reference for the microphone amplifier
MUTET	19	15	transmit channel mute input
MOUT	20	16	microphone amplifier output
GAT	21	17	microphone gain adjustment
MIC	22	18	microphone input
RNOI	23	19	receive noise envelope timing adjustment
RENV	24	20	receive signal envelope timing adjustment
RSEN	25	21	receive signal envelope sensitivity adjustment
TNOI	26	22	transmit noise envelope timing adjustment
TENV	27	23	transmit signal envelope timing adjustment
TSEN	28	24	transmit signal envelope sensitivity adjustment

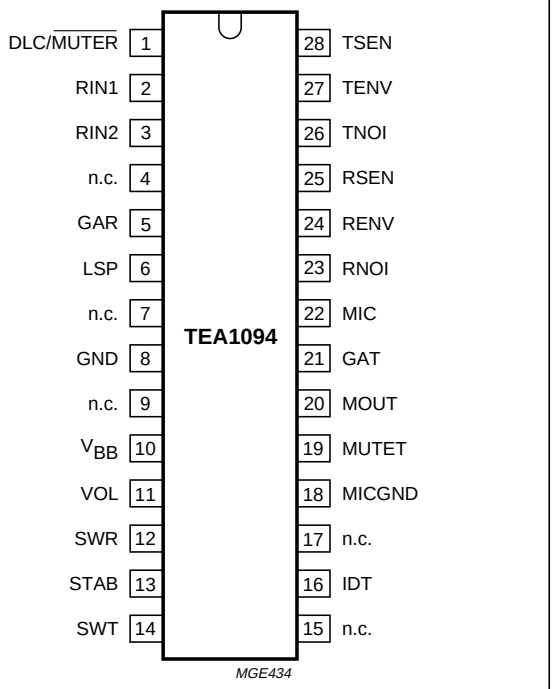


Fig.2 Pin configuration (TEA1094).

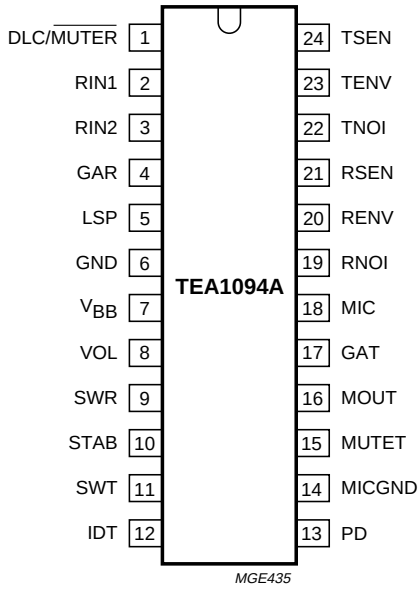


Fig.3 Pin configuration (TEA1094A).

FUNCTIONAL DESCRIPTION

General

The values given in the functional description are typical values unless otherwise specified.

A principle diagram of the TEA106X is shown on the left side of Fig.4. The TEA106X is a transmission circuit of the TEA1060 family intended for hand-set operation.
It incorporates a receiving amplifier for the earpiece, a transmit amplifier for the microphone and a hybrid.
For more details on the TEA1060 family, please refer to *"data Handbook IC03"*. The right side of Fig.4 shows a principle diagram of the TEA1094 and TEA1094A, hands-free add-on circuits with a microphone amplifier, a loudspeaker amplifier and a duplex controller.

As can be seen from Fig.4, a loop is formed via the sidetone network in the transmission circuit and the acoustic coupling between loudspeaker and microphone of the hands-free circuit. When this loop gain is greater than 1, howling is introduced. In a full duplex application, this would be the case.
The loop-gain has to be much lower than 1 and therefore has to be decreased to avoid howling. This is achieved by the duplex controller. The duplex controller of the TEA1094 and TEA1094A detects which channel has the 'largest' signal and then controls the gain of the microphone amplifier and the loudspeaker amplifier so that the sum of the gains remains constant.
As a result, the circuit can be in three stable modes:

1. Transmit mode (Tx mode).

   The gain of the microphone amplifier is at its maximum and the gain of the loudspeaker amplifier is at its minimum.

2. Receive mode (Rx mode).

   The gain of the loudspeaker amplifier is at its maximum and the gain of the microphone amplifier is at its minimum.

3. Idle mode.

   The gain of the amplifiers is halfway between their maximum and minimum value.

The difference between the maximum gain and minimum gain is called the switching range.

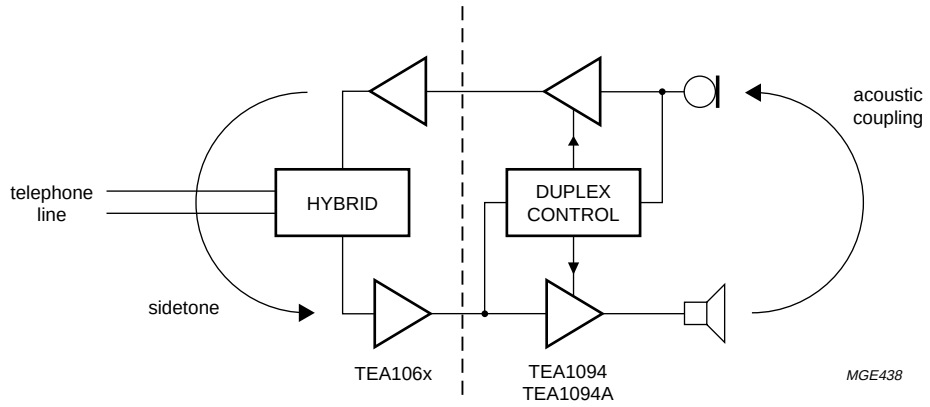


Fig.4 Hands-free telephone set principles.

Supply: pins V_{BB}, GND and PD

The TEA1094 and TEA1094A must be supplied with an external stabilized voltage source between pins V_{BB} and GND. In the idle mode, without any signal, the internal supply current is 3.1 mA at V_{BB} = 5 V.

To reduce the current consumption during pulse dialling or register recall (flash), the TEA1094A is provided with a power-down (PD) input. When the voltage on PD is HIGH the current consumption from V_{BB} is 180 μA.

Microphone channel: pins MIC, GAT, MOUT, MICGND and MUTET (see Fig.5)

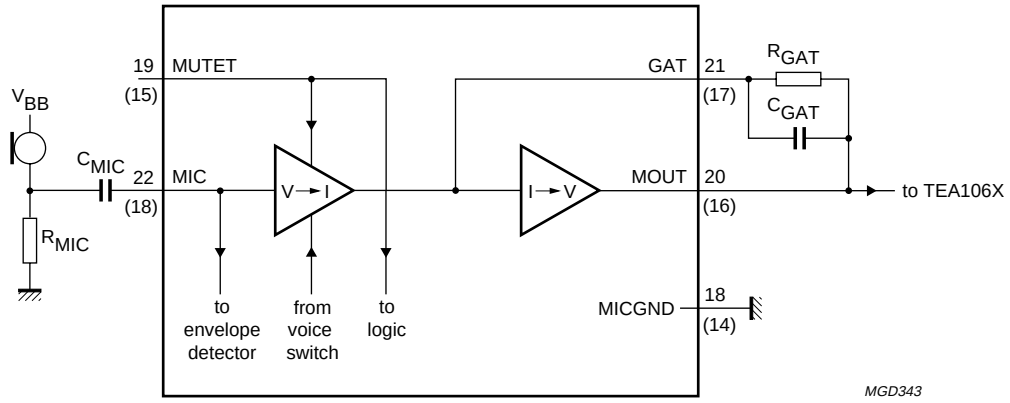
The TEA1094 and TEA1094A have an asymmetrical microphone input MIC with an input resistance of 20 kΩ. The gain of the input stage varies according to the mode of the TEA1094 and TEA1094A. In the transmit mode, the gain is at its maximum; in the receive mode, it is at its minimum and in the idle mode, it is halfway between maximum and minimum.

Switch-over from one mode to the other is smooth and click-free. The output capability at pin MOUT is 20 μA (RMS).

In the transmit mode, the overall gain of the microphone amplifier (from pins MIC to MOUT) can be adjusted from 0 dB up to 31 dB to suit specific application requirements. The gain is proportional to the value of R_{GAT} and equals 15.5 dB with R_{GAT} = 30.1 kΩ.

A capacitor must be connected in parallel with R_{GAT} to ensure stability of the microphone amplifier. Together with R_{GAT}, it also provides a first-order low-pass filter.

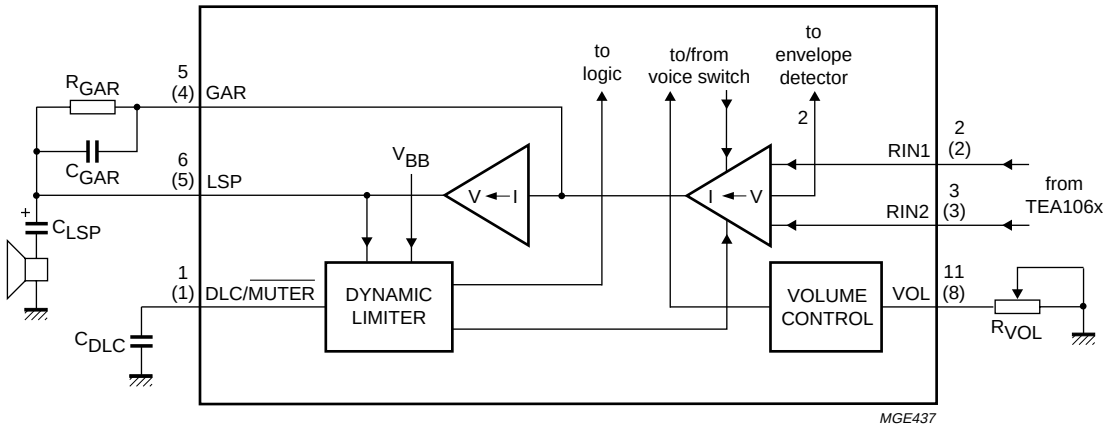
By applying a HIGH level on pin MUTET, the microphone amplifier is muted and the TEA1094 and TEA1094A are automatically forced into the receive mode.



The pin numbers given in parenthesis refer to the TEA1094A.

Fig.5 Microphone channel.

Loudspeaker channel



The pin numbers given in parenthesis refer to the TEA1094A.

Fig.6 Loudspeaker channel.

LOUDSPEAKER AMPLIFIER: PINS RIN1, RIN2, GAR AND LSP

The TEA1094 and TEA1094A have symmetrical inputs for the loudspeaker amplifier with an input resistance of 40 kΩ between RIN1 and RIN2 (2×20 kΩ). The input stage can accommodate signals up to 390 mV (RMS) at room temperature for 2% of total harmonic distortion (THD). The gain of the input stage varies according to the mode of the TEA1094 and TEA1094A. In the receive mode, the gain is at its maximum; in the transmit mode, it is at its minimum and in the idle mode, it is halfway between maximum and minimum. Switch-over from one mode to the other is smooth and click-free. The rail-to-rail output stage is designed to power a loudspeaker connected as a single-ended load (between LSP and GND).

In the receive mode, the overall gain of the loudspeaker amplifier can be adjusted from 0 dB up to 33 dB to suit specific application requirements. The gain from RIN1 and RIN2 to LSP is proportional to the value of R_{GAR} and equals 18.5 dB with R_{GAR} = 66.5 kΩ. A capacitor connected in parallel with R_{GAR} can be used to provide a first-order low-pass filter.

VOLUME CONTROL: PIN VOL

The loudspeaker amplifier gain can be adjusted with the potentiometer R_{VOL}. A linear potentiometer can be used to obtain logarithmic control of the gain at the loudspeaker amplifier. Each 950 Ω increase of R_{VOL} results in a gain loss of 3 dB. The maximum gain reduction with the volume control is internally limited to the switching range.

DYNAMIC LIMITER: PIN DLC/$\overline{\text{MUTER}}$

The dynamic limiter of the TEA1094 and TEA1094A prevents clipping of the loudspeaker output stage and protects the operation of the circuit when the supply voltage at V_{BB} falls below 2.9 V.

Hard clipping of the loudspeaker output stage is prevented by rapidly reducing the gain when the output stage starts to saturate. The time in which gain reduction is effected (clipping attack time) is approximately a few milliseconds. The circuit stays in the reduced gain mode until the peaks of the loudspeaker signals no longer cause saturation. The gain of the loudspeaker amplifier then returns to its normal value within the clipping release time (typically 250 ms). Both attack and release times are proportional to the value of the capacitor C_{DLC}. The total harmonic distortion of the loudspeaker output stage, in reduced gain mode, stays below 5% up to 10 dB (minimum) of input voltage overdrive [providing V_{RIN} is below 390 mV (RMS)].

When the supply voltage drops below an internal threshold voltage of 2.9 V, the gain of the loudspeaker amplifier is rapidly reduced (approximately 1 ms). When the supply voltage exceeds 2.9 V, the gain of the loudspeaker amplifier is increased again.

By forcing a level lower than 0.2 V on pin DLC/$\overline{\text{MUTER}}$, the loudspeaker amplifier is muted and the TEA1094 (TEA1094A) is automatically forced into the transmit mode.

Duplex controller

SIGNAL AND NOISE ENVELOPE DETECTORS: PINS TSEN, TENV, TNOI, RSEN, RENV AND RNOI

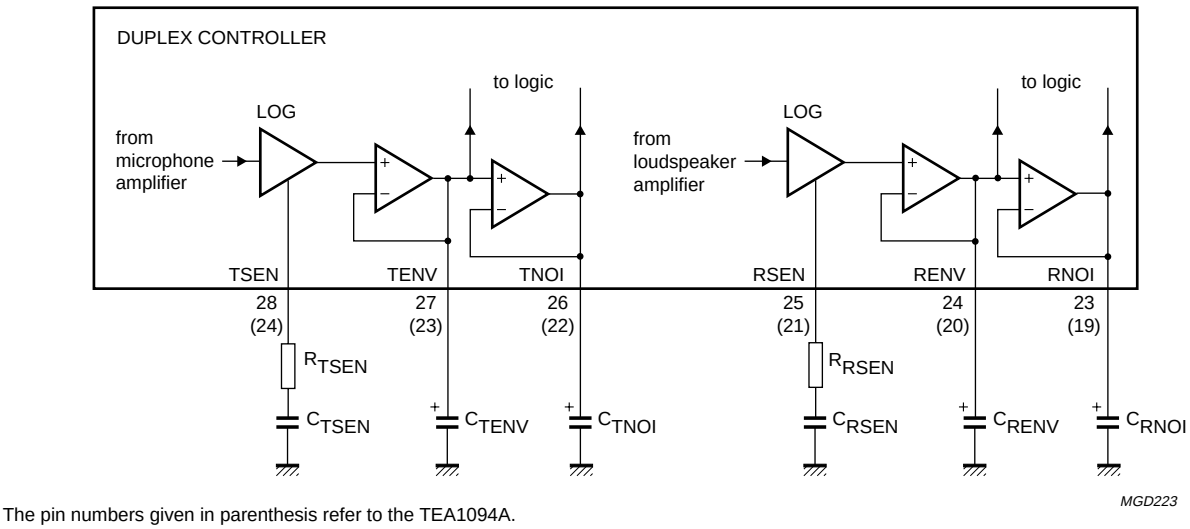
The signal envelopes are used to monitor the signal level strength in both channels. The noise envelopes are used to monitor background noise in both channels. The signal and noise envelopes provide inputs for the decision logic. The signal and noise envelope detectors are shown in Fig.7.

For the transmit channel, the input signal at MIC is 40 dB amplified to TSEN. For the receive channel, the differential signal between RIN1 and RIN2 is 0 dB amplified to RSEN. The signals from TSEN and RSEN are logarithmically compressed and buffered to TENV and RENV respectively. The sensitivity of the envelope detectors is set with R_{TSEN} and R_{RSEN}. The capacitors connected in series with the two resistors block any DC component and form a first-order high-pass filter. In the basic application, see Fig.13, it is assumed that V_{MIC} = 1 mV (RMS) and V_{RIN} = 100 mV (RMS) nominal and both R_{TSEN} and R_{RSEN} have a value of 10 kΩ. With the value of C_{TSEN} and C_{RSEN} at 100 nF, the cut-off frequency is at 160 Hz.

The buffer amplifiers leading the compressed signals to TENV and RENV have a maximum source current of 120 μA and a maximum sink current of 1 μA. Together with the capacitor C_{TENV} and C_{RENV}, the timing of the signal envelope monitors can be set. In the basic application, the value of both capacitors is 470 nF. Because of the logarithmic compression, each 6 dB signal increase means 18 mV increase of the voltage on the envelopes TENV or RENV at room temperature. Thus, timings can be expressed in dB/ms. At room temperature, the 120 μA sourced current corresponds to a maximum rise-slope of the signal envelope of 85 dB/ms. This is sufficient to track normal speech signals. The 1 μA current sunk by TENV or RENV corresponds to a maximum fall-slope of 0.7 dB/ms. This is sufficient for a smooth envelope and also eliminates the effect of echoes on switching behaviour.

To determine the noise level, the signals on TENV and RENV are buffered to TNOI and RNOI. These buffers have a maximum source current of 1 μA and a maximum sink current of 120 μA. Together with the capacitors C_{TNOI} and C_{RNOI}, the timing can be set. In the basic application of Fig.13 the value of both capacitors is 4.7 μF. At room temperature, the 1 μA sourced current corresponds to a maximum rise-slope of the noise envelope of approximately 0.07 dB/ms.

This is small enough to track background noise and not to be influenced by speech bursts. The 120 μA current that is sunk corresponds to a maximum fall-slope of approximately 8.5 dB/ms. However, during the decrease of the signal envelope, the noise envelope tracks the signal envelope so it will never fall faster than approximately 0.7 dB/ms. The behaviour of the signal envelope and noise envelope monitors is illustrated in Fig.8.



The pin numbers given in parenthesis refer to the TEA1094A.

Fig.7 Signal and noise envelope detectors.

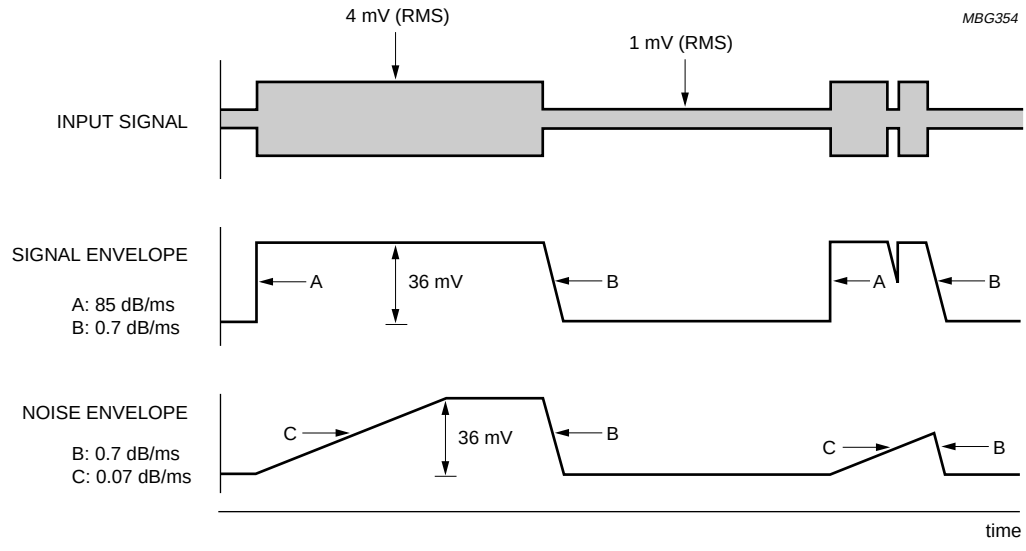
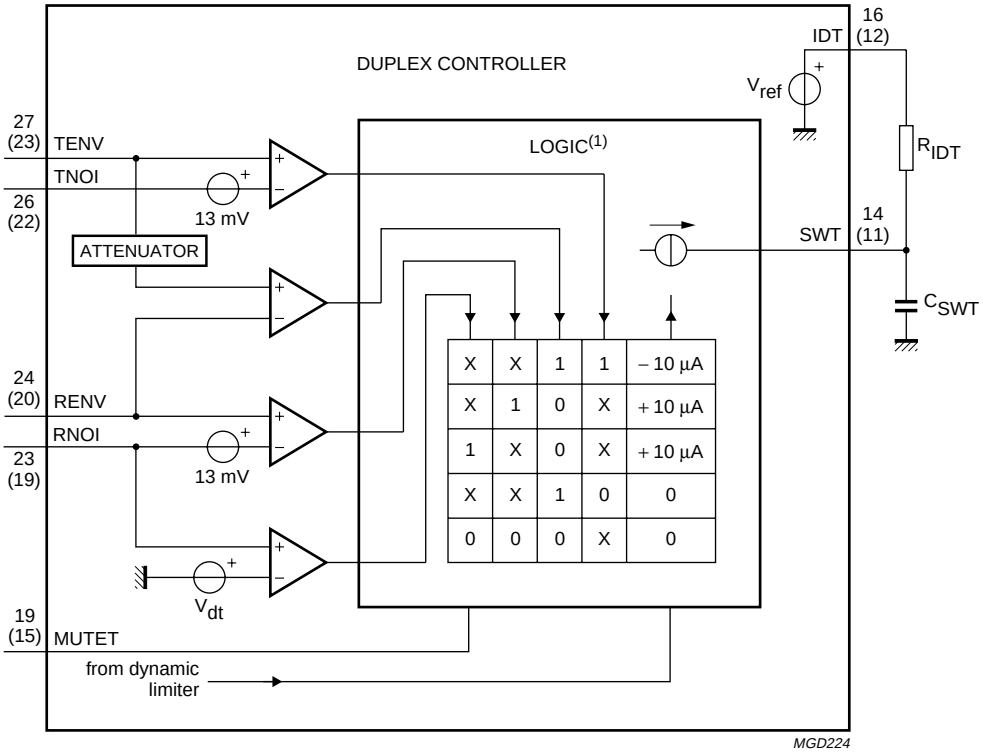


Fig.8 Signal and noise envelope waveforms.

DECISION LOGIC: PINS IDT AND SWT



X	X	1	1	− 10 μA
X	1	0	X	+ 10 μA
1	X	0	X	+ 10 μA
X	X	1	0	0
0	0	0	X	0

The pin numbers given in parenthesis refer to the TEA1094A.

(1) When MUTET = HIGH, +10 μA is forced.
When DLC/$\overline{\text{MUTER}}$ < 0.2 V, −10 μA is forced.

Fig.9 Decision logic.

The TEA1094 and TEA1094A select their modes of operation (transmit, receive or idle mode) by comparing the signal and the noise envelopes of both channels. This is executed by the decision logic. The resulting voltage on pin SWT is the input for the voice-switch.

To facilitate the distinction between signal and noise, the signal is considered as speech when its envelope is more than 4.3 dB above the noise envelope. At room temperature, this is equal to a voltage difference $V_{ENV} - V_{NOI}$ = 13 mV. This so called speech/noise threshold is implemented in both channels.

The signal on MIC contains both speech and the signal coming from the loudspeaker (acoustic coupling). When receiving, the contribution from the loudspeaker overrules the speech.

As a result, the signal envelope on TENV is formed mainly by the loudspeaker signal. To correct this, an attenuator is connected between TENV and the TENV/RENV comparator. Its attenuation equals that applied to the microphone amplifier.

When a dial tone is present on the line, without monitoring, the tone would be recognized as noise because it is a signal with a constant amplitude. This would cause the TEA1094 (TEA1094A) to go into the idle mode and the user of the set would hear the dial tone fade away. To prevent this, a dial tone detector is incorporated which, in standard applications, does not consider input signals between RIN1 and RIN2 as noise when they have a level greater than 127 mV (RMS). This level is proportional to R_{RSEN}.

As can be seen from Fig.9, the output of the decision logic is a current source. The logic table gives the relationship between the inputs and the value of the current source. It can charge or discharge the capacitor C_{SWT} with a current of 10 μA (switch-over). If the current is zero, the voltage on SWT becomes equal to the voltage on IDT via the high-ohmic resistor R_{IDT} (idling). The resulting voltage difference between SWT and IDT determines the mode of the TEA1094 (TEA1094A) and can vary between −400 and +400 mV (see Table 1).

Table 1 Modes of TEA1094; TEA1094A

$V_{SWT} - V_{IDT}$ (mV)	MODE
<−180	transmit mode
0	idle mode
>180	receive mode

The switch-over timing can be set with C_{SWT}, the idle mode timing with C_{SWT} and R_{IDT}. In the basic application given in Fig.13, C_{SWT} is 220 nF and R_{IDT} is 2.2 MΩ. This enables a switch-over time from transmit to receive mode or vice-versa of approximately 13 ms (580 mV swing on SWT). The switch-over time from idle mode to transmit mode or receive mode is approximately 4 ms (180 mV swing on SWT).

The switch-over time, from receive mode or transmit mode to idle mode, is equal to $4 \times R_{IDT}C_{SWT}$ and is approximately 2 seconds (idle mode time).

The inputs MUTET and DLC/$\overline{\text{MUTER}}$ overrule the decision logic. When MUTET goes HIGH, the capacitor C_{SWT} is charged with 10 μA thus resulting in the receive mode. When the voltage on pin DLC/$\overline{\text{MUTER}}$ goes lower than 0.2 V, the capacitor C_{SWT} is discharged with 10 μA thus resulting in the transmit mode.

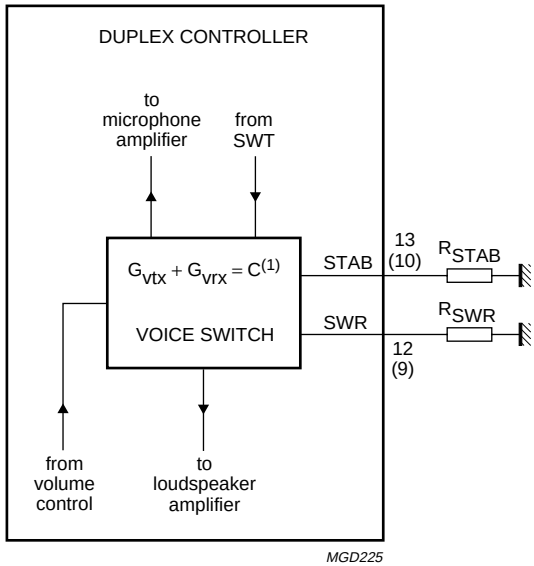
VOICE-SWITCH: PINS STAB AND SWR

A diagram of the voice-switch is illustrated in Fig.10. With the voltage on SWT, the TEA1094 (TEA1094A) voice-switch regulates the gains of the transmit and the receive channel so that the sum of both is kept constant.

In the transmit mode, the gain of the microphone amplifier is at its maximum and the gain of the loudspeaker amplifier is at its minimum. In the receive mode, the opposite applies. In the idle mode, both microphone and loudspeaker amplifier gains are halfway.

The difference between maximum and minimum is the so called switching range. This range is determined by the ratio of R_{SWR} and R_{STAB} and is adjustable between 0 and 52 dB. R_{STAB} should be 3.65 kΩ and sets an internally used reference current. In the basic application diagram given in Fig.13, R_{SWR} is 365 kΩ which results in a switching range of 40 dB. The switch-over behaviour is illustrated in Fig.11.

In the receive mode, the gain of the loudspeaker amplifier can be reduced using the volume control. Since the voice-switch keeps the sum of the gains constant, the gain of the microphone amplifier is increased at the same time (see dashed curves in Fig.11). In the transmit mode, however, the volume control has no influence on the gain of the microphone amplifier or the gain of the loudspeaker amplifier. Consequently, the switching range is reduced when the volume is reduced. At maximum reduction of volume, the switching range becomes 0 dB.



The pin numbers given in parenthesis refer to the TEA1094A.

(1) C = constant.

Fig.10 Voice switch.

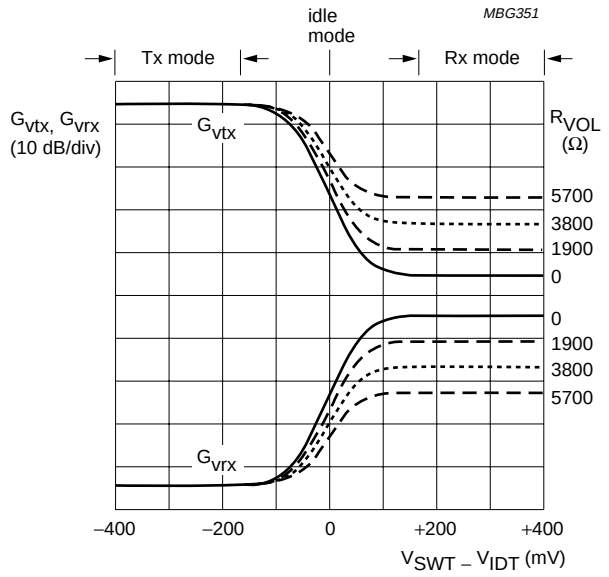


Fig.11 Switch-over behaviour.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{n(max)}$	maximum voltage on all pins; except pins V_{BB}, RIN1 and RIN2		V_{GND} − 0.4	V_{BB} + 0.4	V
$V_{RIN(max)}$	maximum voltage on pins RIN1 and RIN2		V_{GND} − 1.2	V_{BB} + 0.4	V
$V_{BB(max)}$	maximum voltage on pin V_{BB}		V_{GND} − 0.4	12.0	V
P_{tot}	total power dissipation	T_{amb} = 75 °C			
	TEA1094		–	1000	mW
	TEA1094A		–	910	mW
	TEA1094T		–	625	mW
	TEA1094AT		–	590	mW
	TEA1094AM		–	438	mW
T_{stg}	IC storage temperature		–40	+125	°C
T_{amb}	operating ambient temperature		–25	+75	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air		
	TEA1094	45	K/W
	TEA1094A	50	K/W
	TEA1094T	70	K/W
	TEA1094AT	75	K/W
	TEA1094AM	104	K/W

CHARACTERISTICS

V_{BB} = 5 V; V_{GND} = 0 V; f = 1 kHz; T_{amb} = 25 °C; MUTET = LOW; PD = LOW (TEA1094A only); R_L = 50 Ω; R_{VOL} = 0 Ω; measured in test circuit of Fig.12; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply (V_{BB}, GND and PD)						
V_{BB}	supply voltage		3.3	–	12.0	V
I_{BB}	current consumption from pin V_{BB}		–	3.1	4.4	mA
POWER-DOWN INPUT PD (TEA1094A ONLY)						
V_{IL}	LOW level input voltage		V_{GND} − 0.4	–	0.3	V
V_{IH}	HIGH level input voltage		1.5	–	V_{BB} + 0.4	V
I_{PD}	input current	PD = HIGH	–	2.5	5	µA
$I_{BB(PD)}$	current consumption from pin V_{BB} in power-down condition	PD = HIGH	–	180	240	µA
Microphone channel (MIC, GAT, MOUT, MUTET and MICGND)						
MICROPHONE AMPLIFIER						
$\|Z_i\|$	input impedance between pins MIC and MICGND		17	20	23	kΩ
G_{vtx}	voltage gain from pin MIC to MOUT in transmit mode	V_{MIC} = 1 mV (RMS)	13	15.5	18	dB
ΔG_{vtxr}	voltage gain adjustment with R_{GAT}		–15.5	–	+15.5	dB
ΔG_{vtxT}	voltage gain variation with temperature referenced to 25 °C	V_{MIC} = 1 mV (RMS); T_{amb} = –25 to +75 °C	–	±0.3	–	dB
ΔG_{vtxf}	voltage gain variation with frequency referenced to 1 kHz	V_{MIC} = 1 mV (RMS); f = 300 to 3400 Hz	–	±0.3	–	dB
V_{notx}	noise output voltage at pin MOUT	pin MIC connected to MICGND through 200 Ω in series with 10 µF; psophometrically weighted (P53 curve)	–	–100	–	dBmp

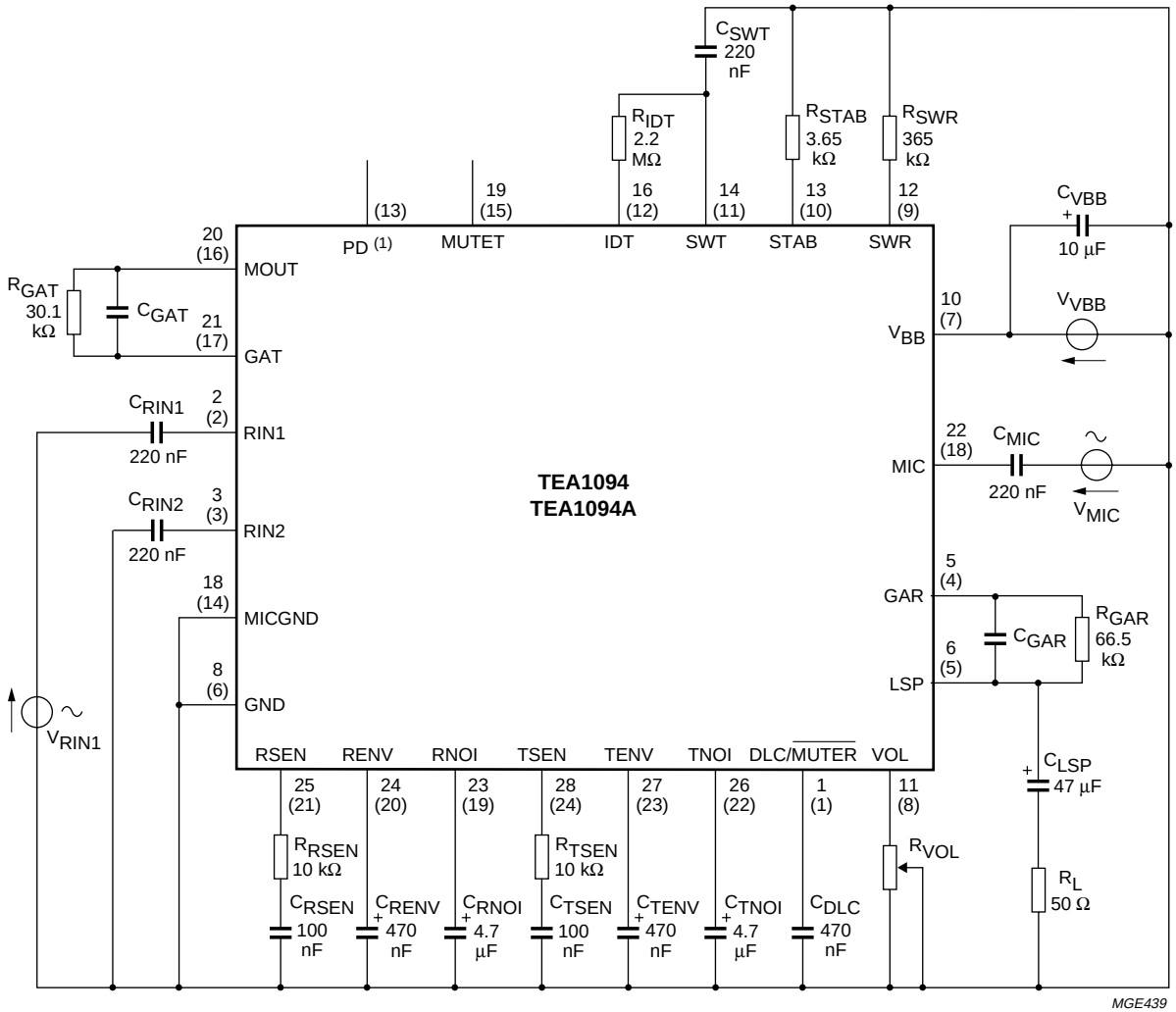
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
TRANSMIT MUTE INPUT MUTET						
V_{IL}	LOW level input voltage		V_{GND} – 0.4	–	0.3	V
V_{IH}	HIGH level input voltage		1.5	–	V_{BB} + 0.4	V
I_{MUTET}	input current	MUTET = HIGH	–	2.5	5	μA
ΔG_{vtxm}	voltage gain reduction with MUTET active	MUTET = HIGH	–	80	–	dB
Loudspeaker channel (RIN1, RIN2, GAR, LSP and DLC/$\overline{\text{MUTER}}$)						
LOUDSPEAKER AMPLIFIER						
$\|Z_i\|$	input impedance	between pins RIN1 or RIN2 and GND	17	20	23	kΩ
		between pins RIN1 and RIN2	34	40	46	kΩ
G_{vrx}	voltage gain in receive mode; between RIN1 and RIN2 to LSP	V_{RIN} = 20 mV (RMS)	16	18.5	21	dB
ΔG_{vrxr}	voltage gain adjustment with R_{GAR}		–18.5	–	+14.5	dB
ΔG_{vrxT}	voltage gain variation with temperature referenced to 25 °C	V_{RIN} = 20 mV (RMS); T_{amb} = –25 to +75 °C	–	±0.3	–	dB
ΔG_{vrxf}	voltage gain variation with frequency referenced to 1 kHz	V_{RIN} = 20 mV (RMS); f = 300 to 3400 Hz	–	±0.3	–	dB
$V_{RIN(rms)}$	maximum input voltage between RIN1 and RIN2 (RMS value)	R_{GAR} = 11.8 kΩ; for 2% THD in input stage	–	390	–	mV
$V_{norx(rms)}$	noise output voltage at pin LSP (RMS value)	inputs RIN1 and RIN2 short-circuited through 200 Ω in series with 10 μF; psophometrically weighted (P53 curve)	–	80	–	μV
CMRR	common mode rejection ratio		–	50	–	dB
ΔG_{vrxv}	voltage gain variation related to ΔR_{VOL} = 950 Ω	when total attenuation does not exceed the switching range	–	3	–	dB
OUTPUT CAPABILITY						
$V_{OSE(p-p)}$	output voltage (peak-to-peak value)	V_{RIN} = 300 mV (RMS); note 1	3.5	4.5	–	V
		V_{RIN} = 150 mV (RMS); R_{GAR} = 374 kΩ; R_L = 33 Ω; V_{BB} = 9.0 V; note 2	–	7.5	–	V
I_{OM}	maximum output current at LSP (peak value)		150	500	–	mA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
DYNAMIC LIMITER						
t_{att}	attack time when V_{RIN} jumps from 20 mV to 20 mV + 10 dB	R_{GAR} = 374 kΩ	–	–	5	ms
t_{rel}	release time when V_{RIN} jumps from 20 mV + 10 dB to 20 mV	R_{GAR} = 374 kΩ	–	250	–	ms
THD	total harmonic distortion at V_{RIN} = 20 mV + 10 dB	R_{GAR} = 374 kΩ; $t > t_{att}$	–	0.9	5	%
$V_{BB(th)}$	V_{BB} limiter threshold		–	2.9	–	V
t_{att}	attack time when V_{BB} jumps below $V_{BB(th)}$		–	1	–	ms
MUTE RECEIVE						
$V_{DLC(th)}$	threshold voltage required on pin DLC/$\overline{\text{MUTER}}$ to obtain mute receive condition		V_{GND} – 0.4	–	0.2	V
$I_{DLC(th)}$	threshold current sourced by pin DLC/$\overline{\text{MUTER}}$ in mute receive condition	V_{DLC} = 0.2 V	–	100	–	µA
ΔG_{vrxm}	voltage gain reduction in mute receive condition	V_{DLC} < 0.2 V	–	80	–	dB
Envelope and noise detectors (TSEN, TENV, RSEN, RENV, RNOI and TNOI)						
PREAMPLIFIERS						
$G_{v(TSEN)}$	voltage gain from MIC to TSEN		37.5	40	42.5	dB
$G_{v(RSEN)}$	voltage gain between RIN1 and RIN2 to RSEN		–2.5	0	+2.5	dB
LOGARITHMIC COMPRESSOR AND SENSITIVITY ADJUSTMENT						
$\Delta V_{det(TSEN)}$	sensitivity detection on pin TSEN; voltage change on pin TENV when doubling the current from TSEN	I_{TSEN} = 0.8 to 160 µA	–	18	–	mV
$\Delta V_{det(RSEN)}$	sensitivity detection on pin RSEN; voltage change on pin RENV when doubling the current from RSEN	I_{RSEN} = 0.8 to 160 µA	–	18	–	mV
SIGNAL ENVELOPE DETECTORS						
$I_{source(ENV)}$	maximum current sourced from pin TENV or RENV		–	120	–	µA
$I_{sink(ENV)}$	maximum current sunk by pin TENV or RENV		0.75	1	1.25	µA
ΔV_{ENV}	voltage difference between pins RENV and TENV	when 10 µA is sourced from both RSEN and TSEN; envelope detectors tracking; note 3	–	±3	–	mV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
NOISE ENVELOPE DETECTORS						
$I_{source(NOI)}$	maximum current sourced from pins TNOI or RNOI		0.75	1	1.25	µA
$I_{sink(NOI)}$	maximum current sunk by pins TNOI or RNOI		–	120	–	µA
ΔV_{NOI}	voltage difference between pins RNOI and TNOI	when 5 µA is sourced from both RSEN and TSEN; noise detectors tracking; note 3	–	±3	–	mV
DIAL TONE DETECTOR						
$V_{RINDT(rms)}$	threshold level at pins RIN1 and RIN2 (RMS value)		–	127	–	mV
Decision logic (IDT and SWT)						
SIGNAL RECOGNITION						
$\Delta V_{Srx(th)}$	threshold voltage between pins RENV and RNOI to switch-over from receive to idle mode	$V_{RIN} < V_{RINDT}$; note 4	–	13	–	mV
$\Delta V_{Stx(th)}$	threshold voltage between pins TENV and TNOI to switch-over from transmit to idle mode	note 4	–	13	–	mV
SWITCH-OVER						
$I_{source(SWT)}$	current sourced from pin SWT when switching to receive mode		7.5	10	12.5	µA
$I_{sink(SWT)}$	current sunk by pin SWT when switching to transmit mode		7.5	10	12.5	µA
$I_{idle(SWT)}$	current sourced from pin SWT in idle mode		–	0	–	µA
Voice switch (STAB and SWR)						
SWRA	switching range		–	40	–	dB
ΔSWRA	switching range adjustment	with R_{SWR} referenced to 365 kΩ	–40	–	+12	dB
$\lvert\Delta G_v\rvert$	voltage gain variation from transmit mode to idle mode on both channels		–	20	–	dB
G_{tr}	gain tracking ($G_{vtx} + G_{vrx}$) during switching, referenced to idle mode		–	±0.5	–	dB

Notes

1. Corresponds to 50 mW output power.
2. Corresponds to 200 mW output power.
3. Corresponds to ±1 dB tracking.
4. Corresponds to 4.3 dB noise/speech recognition level.



The pin numbers given in parenthesis refer to the TEA1094A.

(1) TEA1094A only.

Fig.12 Test circuit.

APPLICATION INFORMATION

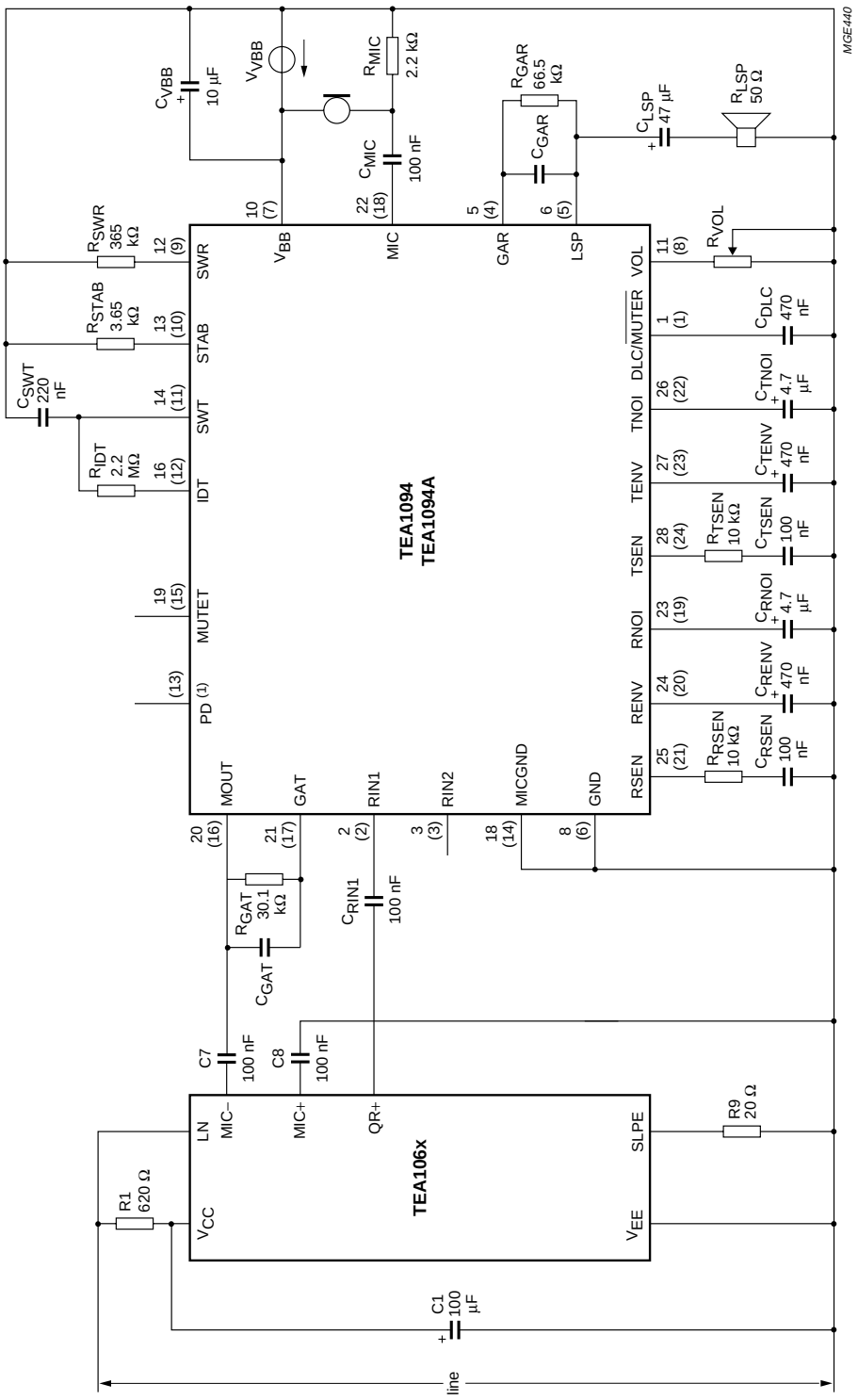


Fig.13 Basic application diagram.

The pin numbers given in parenthesis refer to the TEA1094A.

(1) TEA1094A only.

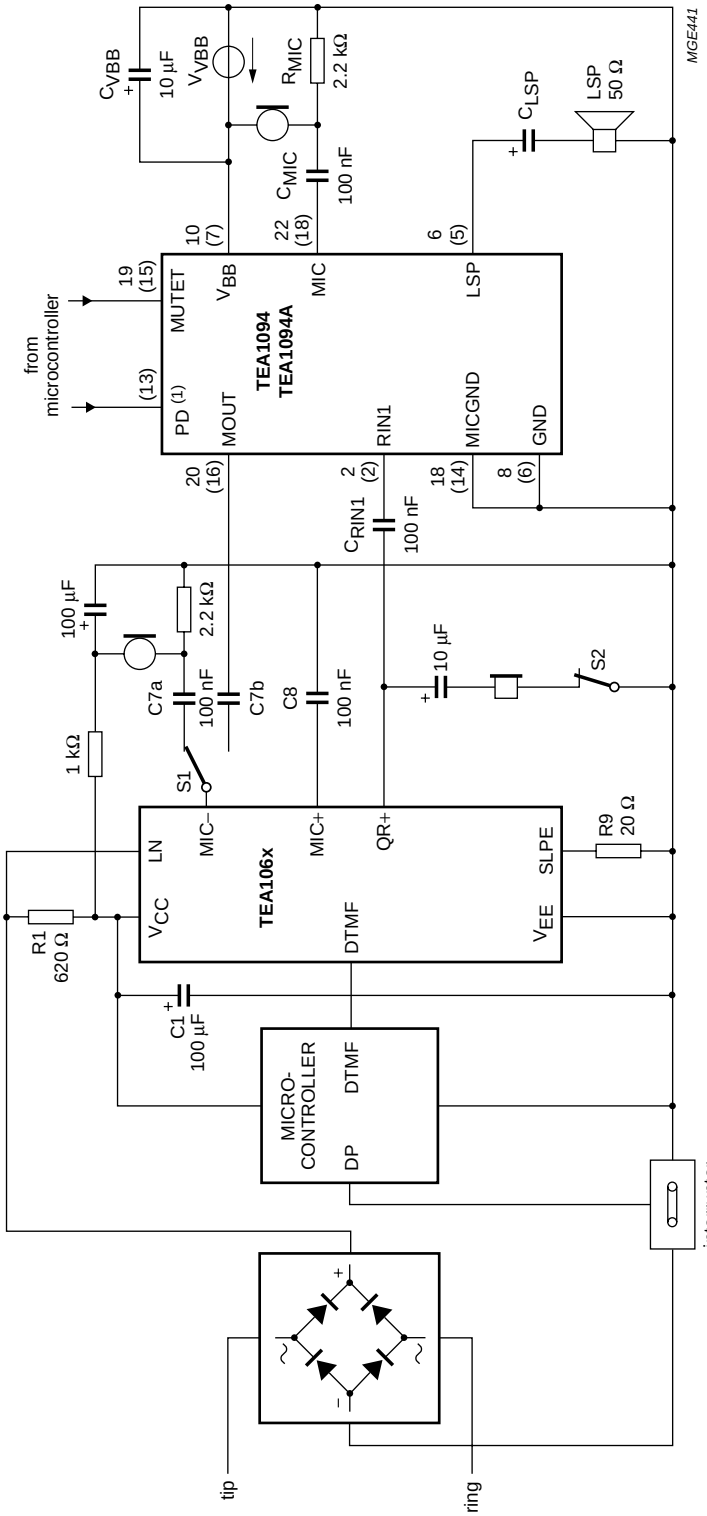


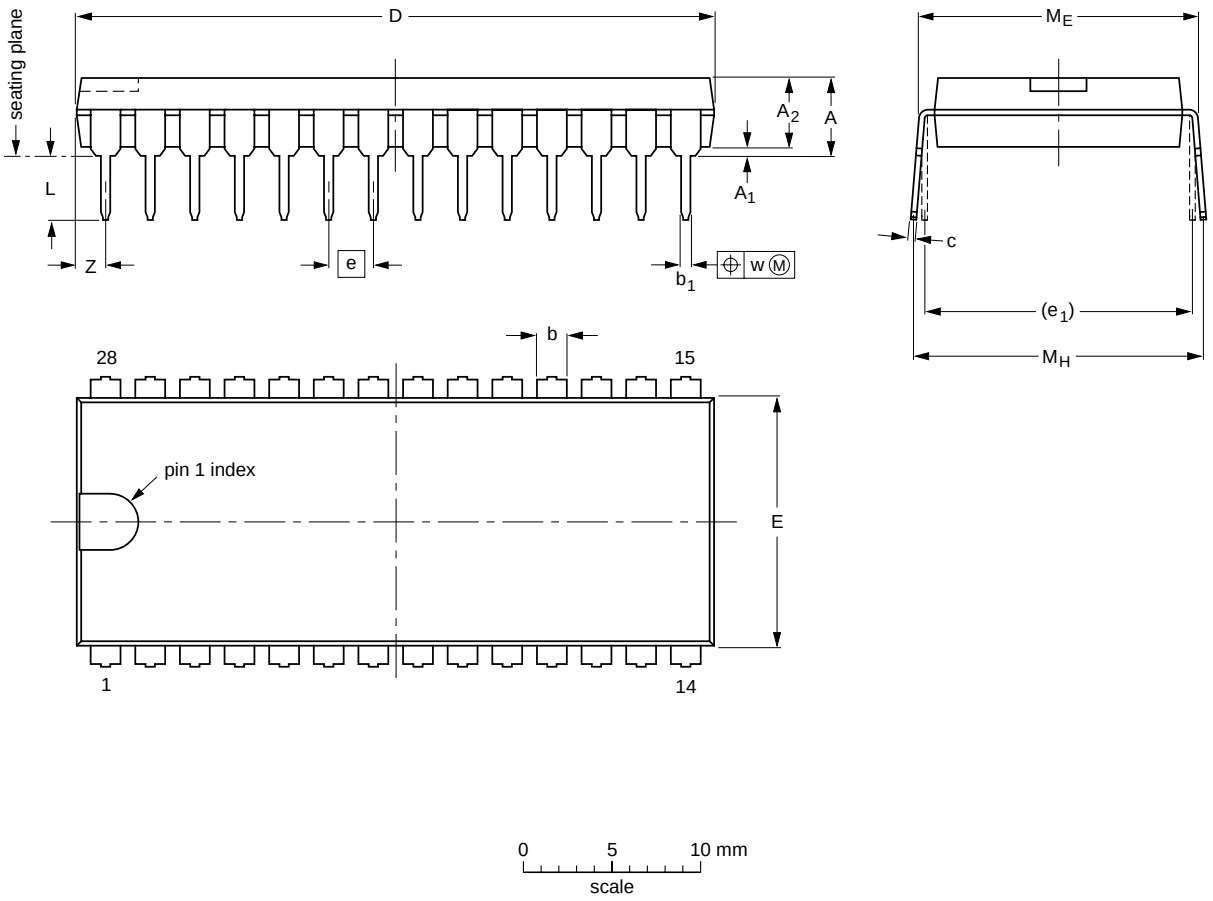
Fig.14 Application example.

The pin numbers given in parenthesis refer to the TEA1094A.

(1) TEA1094A only.

PACKAGE OUTLINES

DIP28: plastic dual in-line package; 28 leads (600 mil) **SOT117-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

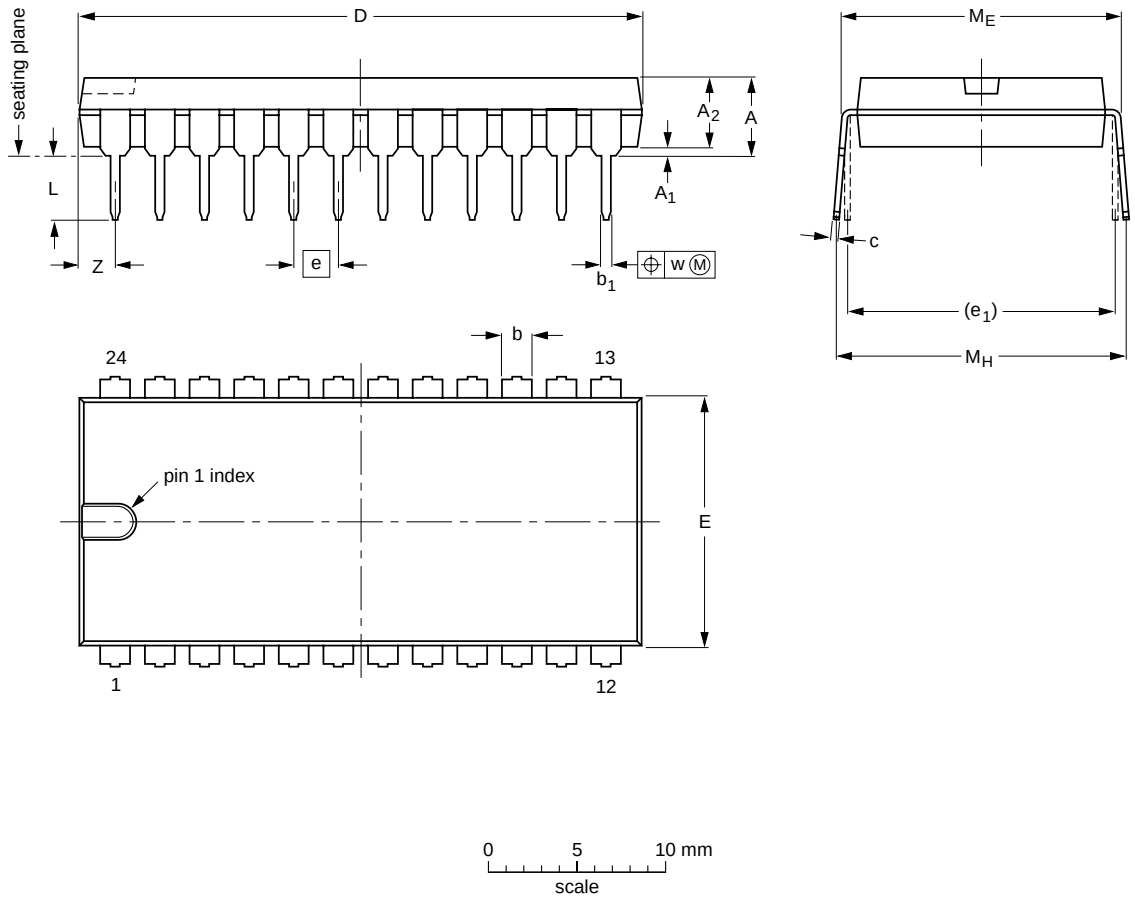
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	5.1	0.51	4.0	1.7 1.3	0.53 0.38	0.32 0.23	36.0 35.0	14.1 13.7	2.54	15.24	3.9 3.4	15.80 15.24	17.15 15.90	0.25	1.7
inches	0.20	0.020	0.16	0.066 0.051	0.020 0.014	0.013 0.009	1.41 1.34	0.56 0.54	0.10	0.60	0.15 0.13	0.62 0.60	0.68 0.63	0.01	0.067

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT117-1	051G05	MO-015AH				~~92-11-17~~ 95-01-14

DIP24: plastic dual in-line package; 24 leads (600 mil) **SOT101-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

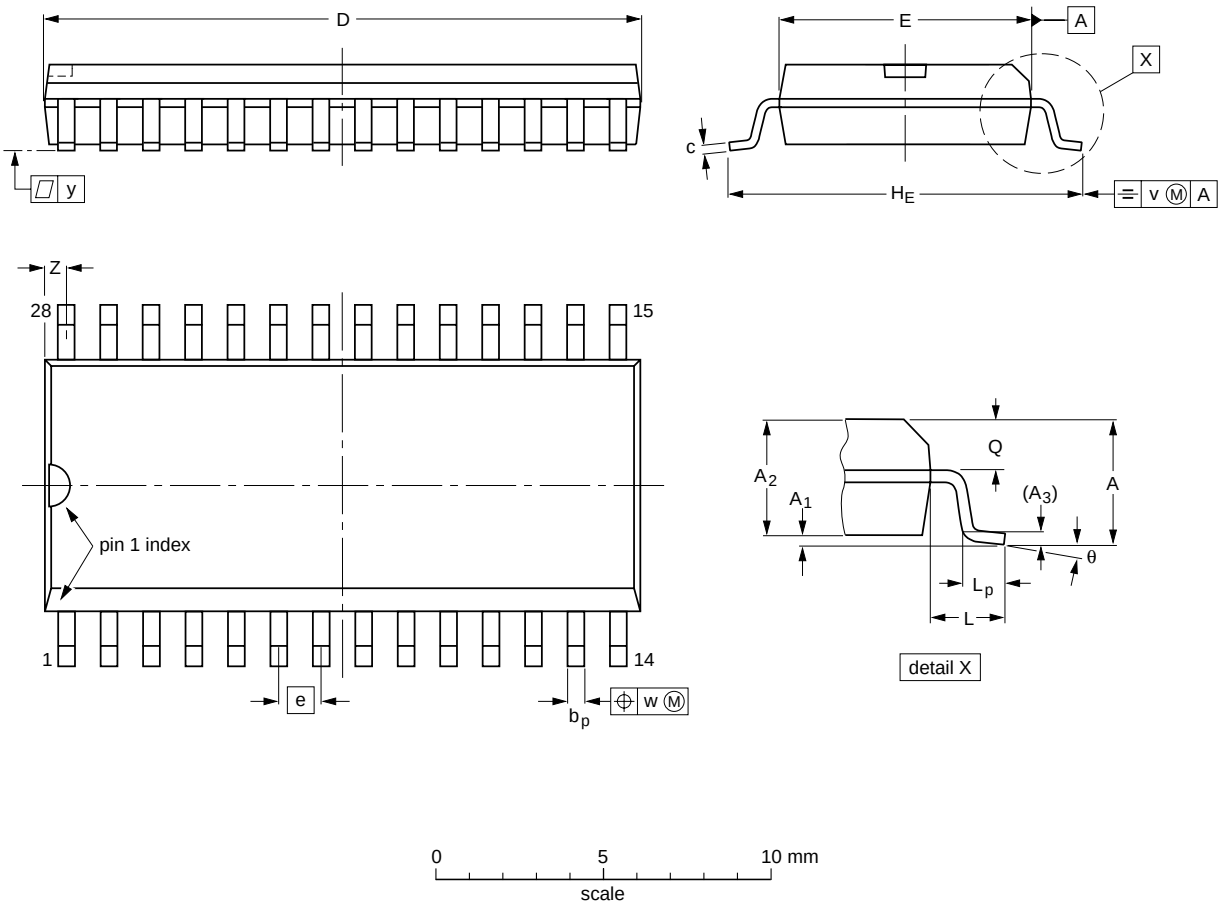
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	5.1	0.51	4.0	1.7 1.3	0.53 0.38	0.32 0.23	32.0 31.4	14.1 13.7	2.54	15.24	3.9 3.4	15.80 15.24	17.15 15.90	0.25	2.2
inches	0.20	0.020	0.16	0.066 0.051	0.021 0.015	0.013 0.009	1.26 1.24	0.56 0.54	0.10	0.60	0.15 0.13	0.62 0.60	0.68 0.63	0.01	0.087

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT101-1	051G02	MO-015AD				~~92-11-17~~ 95-01-23

SO28: plastic small outline package; 28 leads; body width 7.5 mm **SOT136-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

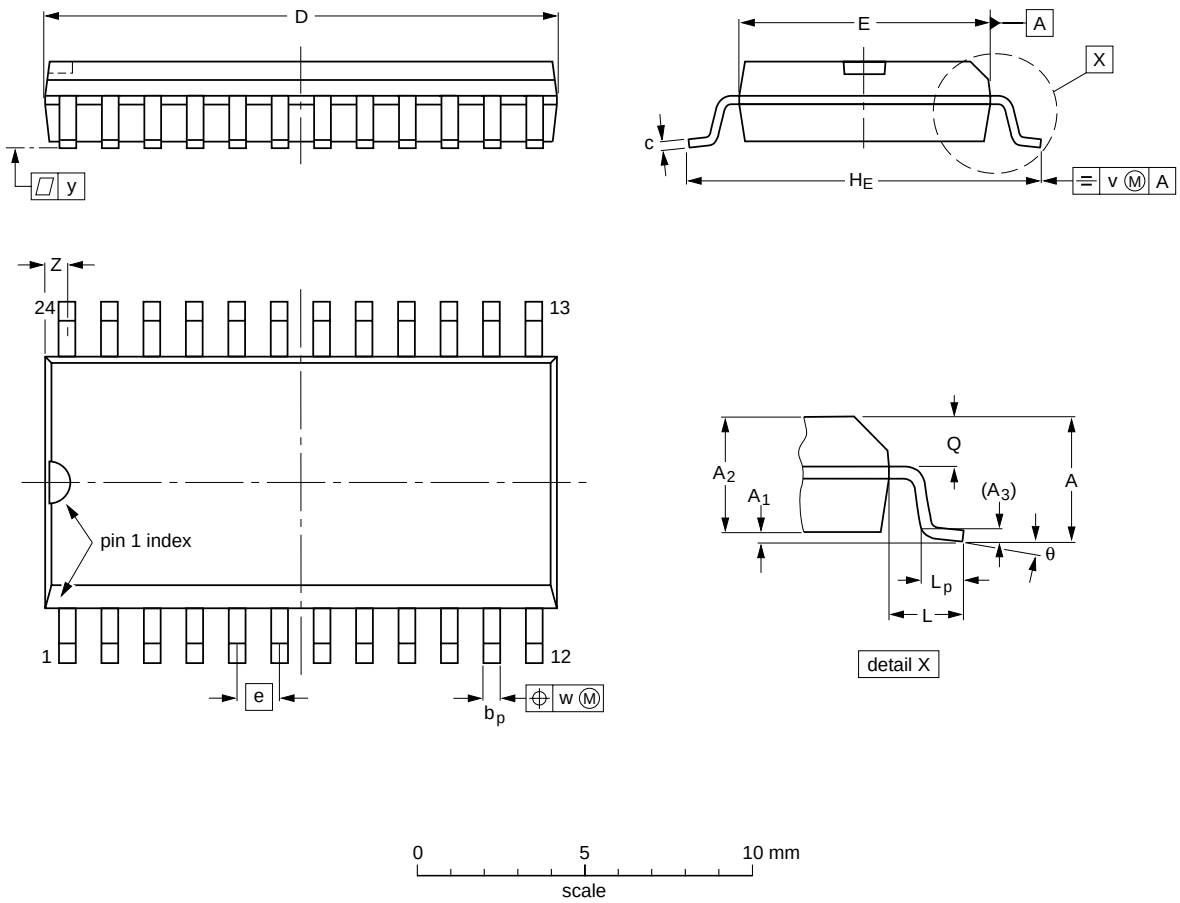
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	18.1 17.7	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.71 0.69	0.30 0.29	0.050	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT136-1	075E06	MS-013AE				~~95-01-24~~ 97-05-22

SO24: plastic small outline package; 24 leads; body width 7.5 mm **SOT137-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

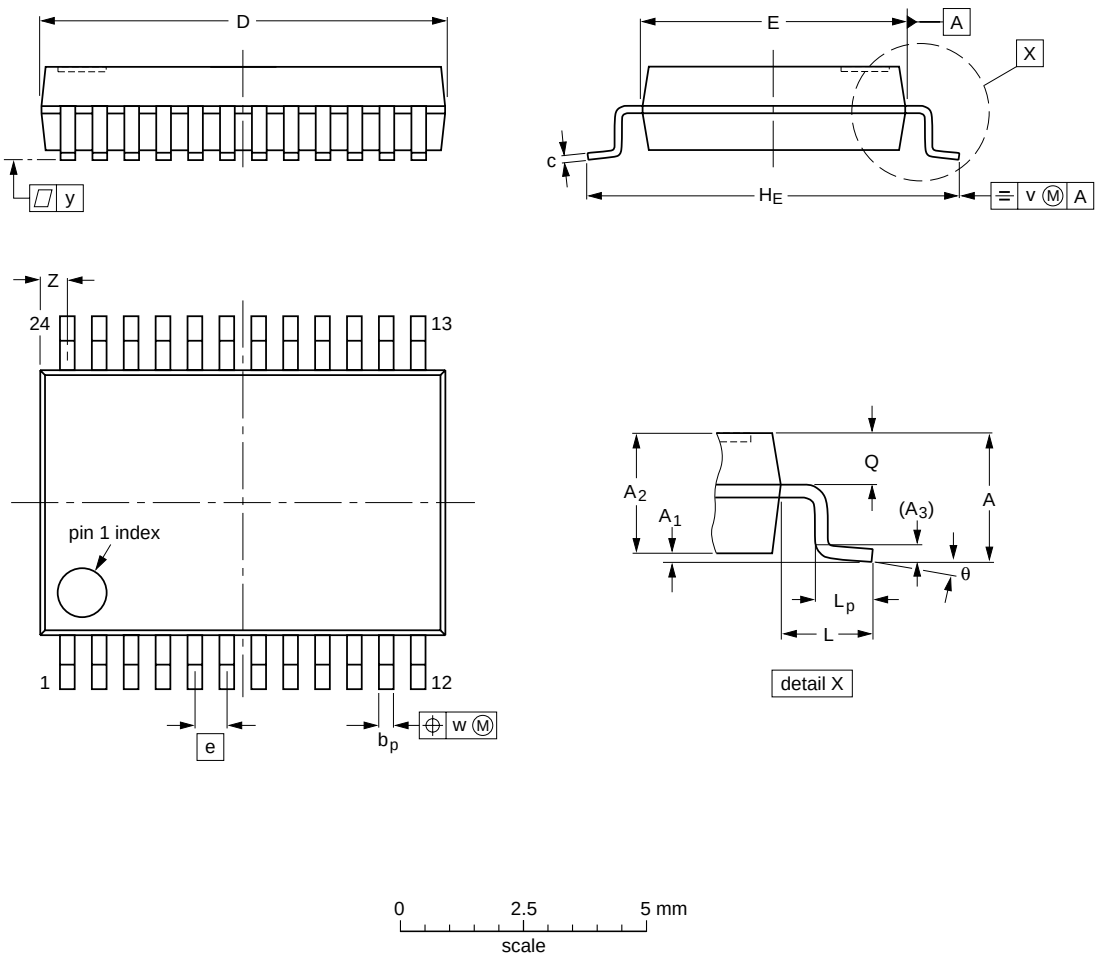
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	15.6 15.2	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.61 0.60	0.30 0.29	0.050	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT137-1	075E05	MS-013AD				~~95-01-24~~ 97-05-22

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm **SOT340-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	8.4 8.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.8 0.4	8^o 0^o

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT340-1		MO-150AG				~~93-09-08~~ 95-02-04

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

DIP

SOLDERING BY DIPPING OR BY WAVE

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

REPAIRING SOLDERED JOINTS

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

SO and SSOP

REFLOW SOLDERING

Reflow soldering techniques are suitable for all SO and SSOP packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

WAVE SOLDERING

Wave soldering is **not** recommended for SSOP packages. This is because of the likelihood of solder bridging due to closely-spaced leads and the possibility of incomplete solder penetration in multi-lead devices.

If wave soldering cannot be avoided, the following conditions must be observed:

- **A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.**
- **The longitudinal axis of the package footprint must be parallel to the solder flow and must incorporate solder thieves at the downstream end.**

Even with these conditions, only consider wave soldering SSOP packages that have a body width of 4.4 mm, that is SSOP16 (SOT369-1) or SSOP20 (SOT266-1).

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

REPAIRING SOLDERED JOINTS

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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Philips Semiconductors – a worldwide company

Argentina: see South America

Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113,
Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

Austria: Computerstr. 6, A-1101 WIEN, P.O. Box 213,
Tel. +43 1 60 101, Fax. +43 1 60 101 1210

Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,
220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

Belgium: see The Netherlands

Brazil: see South America

Bulgaria: Philips Bulgaria Ltd., Energoproject, 15th floor,
51 James Bourchier Blvd., 1407 SOFIA,
Tel. +359 2 689 211, Fax. +359 2 689 102

Canada: PHILIPS SEMICONDUCTORS/COMPONENTS,
Tel. +1 800 234 7381, Fax. +1 708 296 8556

China/Hong Kong: 501 Hong Kong Industrial Technology Centre,
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,
Tel. +852 2319 7888, Fax. +852 2319 7700

Colombia: see South America

Czech Republic: see Austria

Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,
Tel. +45 32 88 2636, Fax. +45 31 57 1949

Finland: Sinikalliontie 3, FIN-02630 ESPOO,
Tel. +358 615 800, Fax. +358 615 80920

France: 4 Rue du Port-aux-Vins, BP317, 92156 SURESNES Cedex,
Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG,
Tel. +49 40 23 52 60, Fax. +49 40 23 536 300

Greece: No. 15, 25th March Street, GR 17778 TAVROS,
Tel. +30 1 4894 339/911, Fax. +30 1 4814 240

Hungary: see Austria

India: Philips INDIA Ltd, Shivsagar Estate, A Block, Dr. Annie Besant Rd.
Worli, MUMBAI 400 018, Tel. +91 22 4938 541, Fax. +91 22 4938 722

Indonesia: see Singapore

Ireland: Newstead, Clonskeagh, DUBLIN 14,
Tel. +353 1 7640 000, Fax. +353 1 7640 200

Israel: RAPAC Electronics, 7 Kehilat Saloniki St, TEL AVIV 61180,
Tel. +972 3 645 0444, Fax. +972 3 648 1007

Italy: PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108,
Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,
Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,
Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,
Tel. +1 800 234 7381, Fax. +1 708 296 8556

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,
Tel. +31 40 27 83749, Fax. +31 40 27 88399

New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,
Tel. +64 9 849 4160, Fax. +64 9 849 7811

Norway: Box 1, Manglerud 0612, OSLO,
Tel. +47 22 74 8000, Fax. +47 22 74 8341

Philippines: Philips Semiconductors Philippines Inc.,
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Ul. Lukiska 10, PL 04-123 WARSZAWA,
Tel. +48 22 612 2831, Fax. +48 22 612 2327

Portugal: see Spain

Romania: see Italy

Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,
Tel. +7 095 926 5361, Fax. +7 095 564 8323

Singapore: Lorong 1, Toa Payoh, SINGAPORE 1231,
Tel. +65 350 2538, Fax. +65 251 6500

Slovakia: see Austria

Slovenia: see Italy

South Africa: S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,
2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000,
Tel. +27 11 470 5911, Fax. +27 11 470 5494

South America: Rua do Rocio 220, 5th floor, Suite 51,
04552-903 São Paulo, SÃO PAULO - SP, Brazil,
Tel. +55 11 821 2333, Fax. +55 11 829 1849

Spain: Balmes 22, 08007 BARCELONA,
Tel. +34 3 301 6312, Fax. +34 3 301 4107

Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM,
Tel. +46 8 632 2000, Fax. +46 8 632 2745

Switzerland: Allmendstrasse 140, CH-8027 ZÜRICH,
Tel. +41 1 488 2686, Fax. +41 1 481 7730

Taiwan: PHILIPS TAIWAN Ltd., 23-30F, 66,
Chung Hsiao West Road, Sec. 1, P.O. Box 22978,
TAIPEI 100, Tel. +886 2 382 4443, Fax. +886 2 382 4444

Thailand: PHILIPS ELECTRONICS (THAILAND) Ltd.,
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,
Tel. +66 2 745 4090, Fax. +66 2 398 0793

Turkey: Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,
Tel. +90 212 279 2770, Fax. +90 212 282 6707

Ukraine: PHILIPS UKRAINE, 2A Akademika Koroleva str., Office 165,
252148 KIEV, Tel. +380 44 476 0297/1642, Fax. +380 44 476 6991

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes,
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

United States: 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,
Tel. +1 800 234 7381, Fax. +1 708 296 8556

Uruguay: see South America

Vietnam: see Singapore

Yugoslavia: PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,
Tel. +381 11 825 344, Fax.+381 11 635 777

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